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ABSTRACT

The study examined relationships among information processing style, intellectual giftedness, and reading ability in 38 young (ages 4-6) gifted children. The children were given the Stanford Binet intelligence test, the Kaufman Assessment Battery for Children and the Peabody Individual Achievement Test. Findings indicated that: (1) intellectual giftedness is related to information processing in young gifted children, specifically in the area of simultaneous processing; (2) intellectual giftedness and reading ability are related in this population but not predictive; (3) sequential processing appears to be related to reading recognition, while simultaneous processing has a closer relationship to reading comprehension; and (4) significant differences were identified between gifted and highly gifted young children (based on IQ) in intellectual giftedness and reading ability. Contains 12 references. (DB)

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The Relationship of Intellectual Giftedness, Information Processing Style, and Reading Ability in Young Gifted Children

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Abstract

The purpose of this study was to examine relationships among information processing style, intellectual giftedness, and reading ability in young gifted children. The instruments, Stanford-Binet, K-ABC Mental Processing Scales, and PIAT Reading Recognition and Reading Comprehension subtests, were administered to the research group (N=38) of identified gifted four to six-year-old children. Data were analyzed using frequency distributions, means, standard deviations, the t-test, and the Pearson product-moment correlation coefficient. Research findings indicated that intellectual giftedness is related to information processing in young gifted children, specifically in the area of simultaneous processing ($r=.73$, $p \leq .001$). Intellectual giftedness and reading ability are related in young gifted children, however, are not predictive ($r=.53$, $p \leq .01$). Sequential processing appears to be related to reading recognition ($r=.57$, $p \leq .001$), while simultaneous processing has a closer relationship to reading comprehension ($r=.82$, $p \leq .05$). Significant differences were determined between gifted and highly gifted young children in intellectual giftedness and reading ability ($p \leq .01$ in recognition and $p \leq .05$ in comprehension). Implications from this study are present in assessment of giftedness and information processing style, curricular adaptations, and program development for gifted and highly gifted young children.

Introduction

The field of education for the gifted has fluctuated throughout history in both strength and visibility. Within this group of gifted children, there have always been intellectually talented and extraordinarily intellectually talented children. Considering the first six years as those most critical in all of life (Fraiberg, 1959), information regarding young intellectually gifted and extraordinarily intellectually gifted children is important both from the perspective of future potential and immediacy of need. Hall (1986) stated, "The single most relevant problem in the field of education of the gifted is a lack of solid research. This problem is even more profound in the area of preschool." As reading ability and intellectual ability appear to have a natural relationship (Swaby, 1983), the area of reading was identified for examination. It is accepted in the field that good program planning is sensitive to information processing styles, and as a result should address processing styles, abilities and preferences in program decision-making. Data regarding the information processing styles of gifted children was sought to further define the differentiating characteristics of these children. Discriminating descriptions of gifted and highly gifted children were also needed as highly gifted children are as different from gifted children as gifted children are from children at the norm (Kline & Meckstroth, 1985).

While educators have increasingly expressed urgency of need, little information exists that relates giftedness with information processing styles and then grounds this information with a discipline. Shore (1986) stated, "Only a small part of research on giftedness to date has really been cognitive

in nature" (p.24). He defined cognitive studies as first; those that examine mental processes, how people think, and second; those that are grounded in relevant theory. By examining the information processing styles of gifted and highly gifted young children, then exploring the reading ability of those children to determine relationships, the results of this research provide insight in the phenomenon of giftedness and suggest possible implications for practice. To create an appropriate learning environment for the gifted or highly gifted, knowledge regarding their information processing styles must be considered in curriculum and program design. Implications regarding discrepancies between processing style and instructional methodologies are potentially crucial to the teaching-learning process. Procedures for identification of giftedness must move beyond merely naming the phenomenon to matching needs of students with specifically designed curricula and programs. As Foster (1986) stated, "When we do research on giftedness we intend to accomplish two things: 1. to better describe the phenomenon and 2. by locating cause/effect relationships connected to that phenomenon, more adequately explain its nature and our effects upon its overall character and development" (p. 33).

The literature provided additional support for examining possible relationships among intellectual giftedness, information processing style and reading ability in young gifted children. Robinson, Roedell, and Jackson (1979) stated, "If intellectually advanced children are precocious not only in overall rate of development but also in the differentiation of their abilities. . . educational programs may have to be adapted to consider variations in talents and learning styles appearing at . . . early ages" (p.138). Differences

in level of skill, creativity measures and ambition were found between groups of children with IQ scores above 145 and those with scores between 125 and 144 by both Lewis (1940) and Barbe (1964). The development of the Kaufman Asssessment Battery for Children prompted a reexamination of information regarding information processing, specifically a dichotomy in style. The K-ABC was based primarily on the theoretical work of Luria (1966), Neisser (1967), and Sperry (1968) and subsequent studies by Das, Kirby and Jarman (1975). Luria suggested simultaneous and successive processing on the basis on his observations of different types of cortical lesions and their behavioural correlates. Das and his colleagues, J. Kirby and R. F. Jarman, proposed a model which defined simultaneous integration as the synthesis of separate elements into groups, the groups often with spatial overtones. Successive information processing referred to processing of information in a serial order. While the sequential-simultaneous models have been challenged in the literature, Kaufman and Kaufman (1983) stated, "Scores on the Mental Processing Scales should be thought of as reflecting complex, integrated mental behavior as well as indicating relative strength or weakness in the two types of intellectual processing" (p.32). In an additional study, Kaufman, Kaufman, Kamphaus, and Naglieri (1982) stated, ". . . we interpret our findings as supportive of the existence of two important and pervasive mental processes--processes which have been identified independently and interpreted somewhat differently by Luria, cerebral specialization researchers, and cognitive psychologists" (p. 79). Reading ability appeared to be related to intellectual ability (Swaby, 1983), however, was not proven to be predictive in gifted or highly gifted children (Roedell, Jackson, and Robinson, 1980). Beginning readers most often

employed a successive processing style, while more sophisticated readers relied on both sucessive and simultaneous modes (Das, Kirby and Jarman, 1979). While information from the literature provided a direction for further research, implications for practice were additionally clearly needed.

Objectives of this research were both general and specific in nature. The general objective was to examine the relationships among information processing style, intellectual giftedness, and reading ability in young gifted children. The specific objectives were:

1. To determine the relationship between intellectual giftedness and information processing style in young gifted children;
2. To determine the relationship between intellectual giftedness and reading ability in young gifted children;
3. To determine the relationship between reading ability and information processing style in young gifted children;
4. To determine differences between young gifted girls and young gifted boys in the areas of reading ability and information processing style;
5. To determine differences between young gifted children and young highly gifted children in the areas of reading ability and information processing style.

Information from the results of this research has clear implications for practice.

Methodology

This research created a statistical picture of the relationships of intellectual giftedness to information processing and to reading ability, of reading ability to information processing, of gender differences in reading ability and information processing, and of differences in intellect, information processing, and reading ability between gifted and highly gifted young children. The sample (N-38) was drawn from identified gifted students at the University of Denver's University Center for Gifted Young Children. The students were ages four years and six months through six years and six months. Giftedness was determined through admission into the University Center where each child was administered an individual assessment including an individual intelligence test (Stanford-Binet Intellignece Scale Form L-M), an individual achievement test (Peabody Individual Achievement Test), and a test of abstract reasoning (Coloured Progressive Matrices). Information was gathered regarding the student's development from his or her parents in addition to parental perceptions of the child. The process of admission met the definition of giftedness as set forth by the Office of Education (Marland, 1972).

To determine information processing style, the Kaufman Assessment Battery for Children, Mental Processing Scales was administered. The Mental Processing Scales define an individual's style of solving problems and processing information (Kaufman & Kaufman, 1983). The Sequential Processing and Simultaneous Processing subtests represent two types of mental functioning. Kaufman and Kaufman (1983) describe these two types as those. . . "that have been identified independently by cerebral

specialization researcher (Bogen, 1975; Gazzaniga, 1975; Kinsbourne, 1978), by Luria (1966, 1970, 1973b) and his followers (Das, Kirby, & Jarman, 1975, 1979), and by cognitive psychologists (Neisser, 1967)" (p.2). Sequential processing focuses on the serial or temporal order of stimuli when solving problems; in contrast, simultaneous processing demands a gestalt-like, frequently spatial, integration of stimuli to solve problems. In the Sequential Processing subtests, problems must be solved by arranging the input in sequential or serial order. The subtests for sequential processing are Hand Movements, Number Recall and Word Order, with the Number Recall subtest considered the "marker" of sequential style. The Simultaneous Processing subtests are organizational in nature and input must be integrated and synthesized simultaneously to produce the appropriate solution. The subtests for simultaneous processing are Magic Windows, Face Recognition, Gestalt Closure, Triangles, Matrix Analogies, Spatial Memory and Photo Series. The Gestalt Closure subtest, which involves the child naming an object or scene pictured in a partially complete "inkblot" drawing, is the "marker" of simultaneous processing style. Kaufman considers the two mental processing scales to be nonhierarchical and equally vital to intellectual functioning.

The Peabody Individual Achievement Test (PIAT) was used in the study to determine reading ability through gathering achievement data regarding reading recognition and reading comprehension. The objective of the Reading Recognition subtest is to measure skills in translating sequences of printed alphabetic symbols which form words, into speech sounds that can be understood by others as words. The rationale of the Reading

Comprehension subtest defines reading as a functional ability, the facility to derive meaning from printed words. VanTassel Baska, (1986) stated, "The best achievement test to use with young gifted children is the PIAT. It provides a ceiling to allow for true measurement of abilities."

The data were converted to Z scores and were statistically analyzed using the t-test and Pearson product-moment correlation coefficient. Relationships were calculated between intellectual giftedness (for the entire group, the gifted (IQ 123-144) group and the highly gifted (IQ $\geq$ 145) group) and sequential processing, simultaneous processing, mental processing, reading recognition achievement, and reading comprehension achievement. Also calculated were relationships between reading recognition achievement and sequential processing, simultaneous processing and mental processing and between reading comprehension achievement and sequential processing, simultaneous processing and mental processing. Significance was determined at the .05 level of confidence. Frequency distributions further described found relationships. The t-test was used to determine whether the gifted group differed significantly from the highly gifted group in the areas of sequential processing, simultaneous processing, mental processing, reading recognition and reading comprehension. Results were also examined for the effect of gender differences.

Results

Intellectual Giftedness and Information Processing

Intellectual giftedness and information processing are related in young gifted children. Numerous significant relationships were indicated

across all three groups: the entire group, the gifted (IQ 123-144) group, and the highly gifted (IQ $\geq$ 145) group. The most significant relationships, both in degree and in quantity, were found in the highly gifted group. Significant relationships ($p \leq .05$) and correlations were indicated in the areas of sequential processing (r=.43), sequential processing subtest Number Recall (r=.48), simultaneous processing (r=.40), simultaneous processing subtests Magic Window (r=-.92), Triangles (r=.47), Spatial Memory (r=-.41), and Photo Series(r=.45), and mental processing (r=.50). The results of the data indicated a highly significant ($p \leq .001$) relationship in the simultaneous processing subtest Gestalt Closure where the correlation was .73. This finding is possibly attributed to highly gifted children's abilities to process in different modes, dependent upon the nature of the task. Of particular interest was the highly significant relationship of the simultaneous processing marker subtest, Gestalt Closure, to intellectual giftedness in the highly gifted group. The highly gifted group appear to be very adept at simultaneous processing. Clark (1983) refers to the intuitive abilities of the gifted. Observation of gifted children often results in an awareness of their abilities to make "intuitive leaps" conceptually. It is suggested that simultaneous processing ability and conceptual intuition may be related and perhaps more efficient in those children identified as highly intellectually gifted. Intellectual giftedness was measured in this study by the Stanford-Binet which was developed considering judgment, comprehension, and reasoning as the essential part of intelligence (Sattler, 1982). To process information well using both styles, sequential and simultaneous, it appears that a subject must be utilizing reason and comprehension respectively. The findings of this component of the research question support the ideas of

Cummins and Das (1977) who purported simultaneous processing to be necessary for the development of more advanced levels of comprehension skills.

Sequential processing and simultaneous processing were highly related to mental processing in young gifted children. For the entire group, the correlation between mental processing and sequential processing (r=.69) was highly significant ($p \leq .001$), as was the correlation between mental processing and simultaneous processing ($r = .87$). The results of the data indicated a highly significant relationship between sequential processing and mental processing ($p \leq .01$) and between simultaneous processing and mental processing ($p \leq .001$) for the gifted group. The correlation coefficients were .55 and .91 respectively. For the highly gifted group, the correlation between mental processing and sequential processing ($r = .77$) was highly significant ($p \leq .001$) as was the correlation between mental processing and simultaneous processing ($r = .86$). These findings support Kaufman and Kaufman (1983) who developed complex intelligence tasks, primarily sequential or simultaneous, that resulted in a mental processing composite. This result supports the use of the K-ABC to determine information about a young gifted child's mental processing as the combination of sequential and simultaneous abilities.

Intellectual Giftedness and Reading Ability

Intellectual giftedness is related to reading ability in young gifted children. Reading recognition was highly significantly related to intellectual giftedness for the entire group ($r = .53$, $p \leq .01$) and for the highly gifted

group (r = .45, p ≤ .05). No significant relationships were indicated for the gifted group. While reading ability is related to intellectual giftedness, it is not predictive. This finding is also supported by the literature (Roedell, Jackson, and Robinson, 1980; Cassidy and Vukelich, 1980).

No significant relationships were indicated between intellectual giftedness and reading comprehension. One factor influencing these results may be the age of the subjects. At the preschool and kindergarten ages, the acquisition of and development of reading skills may be very uneven. Developmental dysyncrony may be manifested in the demonstration of and application of verbal skills. A review of the very broad range of scores on the reading recognition and reading comprehension subtests for the gifted and the highly gifted group provides an additional indication of the relationship between intellectual giftedness and reading ability. This finding is again suggestive of developmental dysyncrony. Even though no significant relationships were indicated between intellectual giftedness and reading comprehension, an extraordinarily highly significant relationship (r = .94, p ≤ .001) was indicated between reading recognition and reading comprehension in young gifted children. While exceptional reading ability may indicate giftedness, a lack of reading ability does not indicate a concurrent lack of giftedness. Programs for gifted young children that select children on the basis of their reading ability must consider additional measures as well.

Reading Ability and Information Processing

The investigation of reading ability and information processing style indicated numerous significant and highly significant relationships. Highly

statistically significant ($p \leq .01$, $p \leq .001$) relationships were indicated in the areas of sequential processing ($r = .57$), sequential processing subtests Hand Movements ($r = .40$), Number Recall ($r = .41$), and Word Order ($r = .43$), simultaneous processing subtests Triangles ($r = .40$), Matrix Analogies ($r = .44$), and Photo Series ($r = .47$), and mental processing ($r = .52$) for the entire group in reading recognition. It is interesting to note that while these correlations are crudely predictive, sequential processing and all sequential processing subtests achieved significance in their relationship to reading recognition. This finding supports the theory of Das, Kirby and Jarman (1979) who suggested the successive (sometimes considered sequential) processing mode is often employed by beginning readers.

Cummins and Das (1977) suggested a positive relationship between simultaneous processing and comprehension skills. Statistically significant ($p \leq .05$) relationships were indicated between reading ability subtests in reading comprehension and simultaneous processing ($r = .82$), simultaneous processing subtests Matrix Analogies ($r = .74$), Spatial Memory ($r = .80$), Photo series ($r = .79$), and mental processing ($r = .79$). These correlations are sufficient for group predictions. Observation of young gifted children often indicates their high level abilities in contextual understanding of written materials. Barbe (1964) identified gifted children with the singular characteristic of sensitivity. This characteristic, however, was applied to the child's entire world, including sensitivity to particular areas of learning. It is suggested that this sensitivity to the written word, whether processed visually or impacted by extensive auditory stimulation, may influence reading comprehension ability. With numerous relationships present in the variables across groups, it appears that better readers rely on both

processing modes and both processing modes are important for success in reading (Hunt and Randhawa, 1983; Das, Kirby and Jarman, 1979). Reading recognition appears to be related to sequential processing and reading comprehension is related to simultaneous processing. However, developmental dysyncrony may affect the level at which both processing modes may be utilized for the demonstration of more adept reading ability.

Gender Differences

The results of the data indicated no differences between young gifted girls and young gifted boys in the areas of reading ability and information processing style, that is, sequential and/or simultaneous processing ability. This finding may be indicative of the age of the subjects involved. Because of the young ages of the sample, these young gifted girls may not yet be socialized to hide their exceptional abilities. However, the finding is concurrent with the literature regarding no differences in intellectual ability between the sexes.

Differences between Gifted and Highly Gifted

The examination of the differences between young gifted children and young highly gifted children indicated significance in some areas. Young gifted children are very different from young highly gifted children in the area of intellectual giftedness ($p \leq .001$), the basis on which the distinction was made. The magnitude of this finding supports the concept present in the literature that highly gifted children are different from gifted children.

The range of IQ scores fell into a natural dichotomy as defined by the literature of ≤ 144 and ≥ 145, providing two groups of equal N. Results of the data did not indicate a significant difference between the gifted and the highly gifted group on the mean scores of sequential processing, simultaneous processing and mental processing composite. This finding also supports the concern regarding use of the K-ABC to identify and further discriminate gifted abilities. Included in the standardization sample of the K-ABC were 200 four-year-old children, 200 five-year-old children and 200 six- year- old children, none of which were specifically selected as gifted. The K-ABC has been utilized with two groups of school-age students, one identified as gifted, the other referred for a gifted program, for the purpose of profile analysis only. The dichotomy of sequential or simultaneous may not have been significant between the gifted and highly gifted groups becasue of the ceiling effect of the K-ABC. In the area of reading ability, the results of the data indicated a highly significant difference ($p \leq .01$) for the gifted group in comparison to the highly gifted group in reading recognition. A significant difference ($p \leq .05$) was indicated between the gifted group and the highly gifted group in reading comprehension. A review of the range of reading recognition and reading comprehension scores indicate extraordinary ability. The significant differences in reading ability between the gifted and highly gifted groups is supported by the hypothesis of Vellutino (1979) which attributes the highly verbal nature of the Stanford-Binet as the underlying variable of success or failure in reading.

Summary of Results

This research indicates that intellectual giftedness is related to information processing in young gifted children, specifically in the area of simultaneous processing. The most significant relationships, both in degree and in quantity, are found in the highly gifted group. Intellectual giftedness in the highly gifted range is closely related to simultaneous processing ($r=.73$, $p \leq .001$). This finding suggest connections with simultaneous processing ability and conceptual intuition (Clark, 1983). Intellectual giftedness and reading ability are related in young gifted children, however, are only crudely predictive ($r= .53$, $p \leq .01$). Sequential processing appears to be related to reading recongnition ($r= .57$, $p \leq .001$), while simultaneous processing is related to reading comprehension ($r= .82$, $p \leq .05$). These findings support Cummins and Das (1977) who suggested a positive relationship between simultaneous processing and comprehension skills. No differences are indicated between young gifted females and young gifted males in information processing and reading ability. Significant differences are present between gifted and highly gifted young children in reading ability ($p \leq .01$ in reading recognition and $p \leq .05$ in reading comprehension). This finding supported Kline and Meckstroth (1985) who stated, "There is as much potential variation in comparing exceptional gifted children and gifted children as in comparing an average children with a child well below the norm" (p.24).

Implications

Implications from the results of this study can be considered from three main perspectives: assessment, both of sequential and/or

simultaneous processing and of giftedness; curriculum development and implementation; and program development. It is apparent that only specific subtests of the K-ABC may be considered for the determination of sequential or simultaneous skills. The Simultaneous Processing subtest Gestalt Closure was identified by Kaufman and Kaufman (1983) as the marker test of simultaneous processing style. Results of the data of this study concurred. Kaufman and Kaufman (1983) determined the marker test of sequential processing to be Number Recall. Again, the results of the data of this study provided support for this identification. If the purpose of an assessment is to identify a child's skill preference for sequential or simultaneous processing, these two subtests alone may be adequate. If a composite picture of the child's abilities in one or both areas of processing is desired, additional subtests are needed. A more complete battery may provide additional information regarding the skill level of specific child.

Recommendations have been made in the literature for the use of the K-ABC to identify giftedness (Kaufman, 1984). It is suggested that great caution be exercised with the use of the K-ABC to identify giftedness in young children. While the test instrument is attractive and appears to be enjoyed by the children, the ceiling effect of the K-ABC prompts some concern. The means of the Mental Processing Composite are much lower than the means of the Stanford-Binet IQ scores for all three groups, the entire group, the gifted group and the highly gifted group. The Stanford-Binet has a long history of acceptance for identification of intellectual giftedness (Clark, 1983) and does identify a certain type of intelligence. While the current trend in the field suggest multiple-criterion measures of

giftedness, it is strongly suggested that the K-ABC Mental Processing Composite is not substituted for the Stanford-Binet in the identification of intellectual giftedness in young children. The early years are the best times to identify and subsequently provide for the exceptional abilities of young gifted children (Hall, 1986), therefore, precautions must be taken not to exclude children from opportunity they both deserve and need.

Information for this study may be applied to curriculum development and implementation. The literature calls for differentiated curriculum for gifted learners (Shore, 1986; Gallagher, 1985; Feldman, 1979; Robinson, Roedell, & Jackson, 1979), however, the need for differentiated curriculum and implementation processes still exists. Programs for gifted young children may be made more efficient and effective through the use of individual educational plans. Through an analysis of a child's specific abilities, more detailed goals may be written to specifically address the needs of that child and subsequently lesson plans may be designed with those needs in focus. Teaching materials may be selected on the basis of introduction of a new processing style or reinforcement of a previously practiced style. The children themselves may be made aware of the types of processing styles that they use, as they begin utilizing the concept of metacognition. As this thinking occurs, experience suggests that the children may become more adept at the skills themselves. Differences in reading ability may be addressed by the inclusion of higher level material which involves abstract concepts and allows for the processing of information simultaneously. Thematic curriculum design provides another vehicle for

students to see relationships and process information in a non-linear manner.

Current trends in the field of education for the gifted indicate levels of programming based on specific needs as demonstrated by the child (Cox, Daniel, & Boston, 1986). This trend is highly supported by the results of this study. Highly gifted children are significantly different from gifted children and therefore require differentiated programming themselves. Within the program options, students may be grouped on the basis of preference of information processing style or introduction of a new skill. As highly gifted readers are significantly different from gifted readers, grouping may again be on the basis of ability. The results of this study have perhaps most importantly indicated a need for the examination of the abilities of individual students with subsequent program and curricular planning based on those needs of individuals.

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